
I. SPECIAL REPORTS**MINUTES OF THE WHEAT CROP GERMPLASM COMMITTEE****22 February, 2004.****Kansas City, MO, USA.**

Attendees: Harold Bockelman, Gina Brown-Guedira (Vice-Chair), Kim Garland Campbell (Chair), Carl Griffey, David Marshall (Secretary), Dave Matthews, Jackie Rudd, Allan Stoner, and Maarten Van Ginkel.

Chairperson Kim Campbell convened the meeting at approximately 9:15 am. The minutes of the December 2002 (for 2003) meeting in Cincinnati, OH, were accepted by voice acclamation. The minutes were published in the 2003 *Annual Wheat Newsletter*, Volume 49, and also distributed previously via E-mail to committee members. Members of the Wheat CGC are Kim Campbell, Carl Griffey, Gina Brown-Guedira, David Marshall, Anne McKendry, Barton Fogleman, Jackie Rudd, and Brian Steffenson; *ex-officio* voting members are USDA–ARS Curator of the National Small Grains Collection (Harold Bockelman), a representative from USDA–ARS–National Germplasm System Database Management Unit (Alan Stoner); a representative from GrainGenes (Dave Matthews); a USDA–ARS CIMMYT representative (Maarten Van Ginkel); and a Canadian representative (vacant). *Ex-Officio* member in an advisory role is the USDA–ARS National Program Leader in Grains (Kay Simmons).

A brief history of the Wheat CGC presented by Kim Campbell and Alan Stoner indicated the former name of the committee (Wheat Crop Advisory Committee) and pointed-out that the objective of the Committee was to serve in an advisory capacity to national wheat (and related species) germ plasm efforts in the collection, cataloguing, preservation, funding priorities, germ plasm enhancement, and open exchange of germ plasm. A suggestion was made to appoint Elias Elias to the Wheat CGC to represent the interests of durum wheat.

Harold Bockelman, Curator of the USDA–ARS National Small Grains Germplasm Collection distributed information concerning the PI assignments during 2003. The PI number assignments for all wheat, rye, triticale, and *Aegilops* accessions were disseminated. Discussion followed on the descriptors used to identify and phenotype accessions. In particular, it was recommended that grain quality descriptors such as grain hardness and NIR protein be added to the descriptor list, using grain produced in Aberdeen as the common location to minimize genotype by environment interaction for these traits.

The inclusion of synthetic wheats into the collection was discussed. H. Bockelman has designated these in the collection as *X Aegilotriticum*. The importance of synthetic wheats was emphasized by G. Brown-Guedira and M. Van Ginkel, particularly with regard to their disease resistance. CIMMYT presently has approximately 1,000 synthetic spring wheats and 250 synthetic winter wheats. Several groups of synthetics also exist at the Wheat Genetics Resource Center in Manhattan, KS.

It was recommended that breeding lines, particularly those with unique characteristics, from uniform nurseries be submitted to the collection. H. Bockelman and coordinators of the regional nurseries will emphasize this to the breeding community. It was suggested that a powder mildew nursery be developed that contains differentials and new mildew-resistant sources. D. Marshall and M. Van Ginkel will coordinate a new international mildew nursery in 2004 that will emphasize adult-plant mildew resistance. Also discussed was the importation and distribution of germ plasm having resistance to Karnal bunt. J. Rudd and G. Brown-Guedira agreed to coordinate efforts to investigate the establishment of a field nursery in Texas for seed increase of materials from CIMMYT.

A. Stoner updated the committee on GRIN (Germplasm Resources Information Network). GRIN presently has 10 computer specialists working on the network. Recent activities include rewriting the public aspects of the website to include a Google-type search engine and examining the capacity to download GRIN data into a database application that will support data descriptors having multiple values and locations. Under development are search links within GRIN that would allow users to simultaneously search GRIN and other germ plasm databases worldwide.

D. Matthews presented the activities of GrainGenes for 2003. Included were new map formats and displays, routine updates, and work toward making the site more user-friendly. A liaison committee consisting of clientele and subject-matter experts was established. Some discussion focused on ways to get high-throughput genotyping data into a

format that was easy for both people submitting the data, as well as people wanting to access the information from the data. Dave has been developing a format in collaboration with Ed Buckler (Maize DB) and Susan McCouch (Gramene). The suggested format includes three independent variables (name, marker, and experiment) and one dependent variable (marker-band size).

An update of activities at CIMMYT was presented by M. Van Ginkel. CIMMYT went through a strategic planning process in 2003 that resulted in changes in the organizational structure of CIMMYT. An update of the reorganization can be found at the CIMMYT website www.cimmyt.org. Germ plasm collection and development at CIMMYT will continue with emphasis and the use of wild relatives and the generation of synthetics. The Iranian landraces at CIMMYT (also just added to the NSGC) are being evaluated for drought and heat tolerance by Richard Trethowan. The international nurseries will continue to be distributed after some delays. Distribution has been split from analysis. Some name changes have occurred reflecting a more regional focus and special traits.

The report on the status and future of wheat germ plasm will be written during 2004, with writing assignments divided among WCG Committee members. Those assignments are enhancement, G. Brown-Guedira; vulnerability, D. Marshall; status of collection, H. Bockelman; collection priorities, K. Campbell; evaluation priorities, C. Griffey; and introduction and crop importance, J. Rudd.

Scott Haley (Colorado State University) discussed his proposal to accelerate germ plasm screening to the new biotype of Russian wheat aphid now found in the Great Plains. A motion was made by C. Griffey, seconded by K. Campbell, and approved by voice vote for the Wheat CGC to endorse the proposal.

The 2003 wheat wild relative collection trip to Kazakhstan was reported on by K. Campbell. A proposed collection trip to Georgia also was discussed.

The meeting concluded with an approved voice vote to distribute germ plasm obtained and screened for FHB resistance through the Scab Initiative, in a timely manner. Kim will contact the germ plasm coordinators for the FHB initiative regarding distribution.

The meeting concluded at approximately 5:00 pm, 22 February, 2002.

***MINUTES OF THE NATIONAL WHEAT IMPROVEMENT COMMITTEE (NWIC)
MEETING.******16 December, 2003.******St. Paul, MN, USA.******Preliminaries.***

The minutes of the January 2003 NWIC meeting were approved as published in the *Annual Wheat Newsletter* (49:6-9).

Annual Wheat Newsletter.

Written reports were submitted from John Raupp (*Annual Wheat Newsletter* publication and editing) and Brett Carver, (*Annual Wheat Newsletter* financial status).

USDA–ARS FY2004 report.

Kay Simmons, USDA–ARS National Program Staff provided an update on the ARS budget and position updates.

- a. Five-year ARS project plan updates,
- b. Highlights of the year included a national wheat genomics sequencing workshop sponsored jointly by ARS and NSF, and
- c. Budget, all ARS add-on projects were restored in the final FY04 budgets.

National Barley Improvement Committee report.

Mike Davis, National Barley Improvement Committee, presented an update on small-grain, federal (U.S. government) budget initiatives. Additional funding for the Cereal Disease Lab in St. Paul, MN, and an research position for invasive aphids at the ARS lab in Stillwater, OK, has been secured. Efforts continue to secure full funding for small grains genotyping centers and for the four regional wheat quality labs.

Buildings and facilities. \$3.9 million was approved for planning and design of new facility at Pullman, WA. The National Agriculture Statistics budget received a funding increase for better estimates of agricultural production. The Hatch Act received some moderate funding increases. NRI funding was diminished somewhat.

CSREES initiatives and activities.

Ann Marie Thro provided an update on CSREES initiatives and activities. The NRI Competitive Grants Program now funds about \$ 164,000,000, with a total budget of approximately \$1,000,000,000. The NRI now has pure research and ‘integrated’ projects, which includes extension, education, and research. CSREES recognizes the importance of continued strong plant breeding programs. CSREES provided funding for the wheat research planning workshop held at the National Wheat Workers Workshop, February 2004. Jorge Dubcovsky (UC–Davis) was the organizer for this meeting.

National Association of Wheat Growers update.

An update from NAWG was provided by Pat Buschette, who indicated that NAWG desires to become more involved in research efforts, wants to work toward development of common goals, and explore ways of integrating NAWG and NWIC efforts. NAWG has the policy of adapting legislative items as defined by NWIC.

Regional reports.

Eastern soft wheat region. Joe Anderson and Jose Costa. Weather impacted yield and quality in the eastern region, impacting quality testing. New ARS positions have been added to the Hessian fly group at Purdue and to the group at Raleigh. Ben Edge has been named to a position at the University of South Carolina as wheat breeder.

Spring wheat region. Marty Carson. Staffing of the genotyping center at Fargo has begun. Yue Jin accepted a position with ARS in the Cereal Disease Lab at St. Paul. The Grain Science Department at NDSU has been eliminated, with staff and activities now largely assigned to the Department of Cereal and Food Science.

Western region. Kim Kidwell and others. Stripe rust was the topic generating the most interest, with epidemics throughout the west, especially in California. Oregon lost 40 % of its extension budget. The USDA–ARS Advanced Genetics Laboratory at Aberdeen will be finished by 2006. The USDA–ARS Western Regional Research Center established a joint project on risk assessment headed by Ann Blechl and David Hou. Work will concentrate on development to promoters for tissue specific expression.

Winter wheat region. Scott Haley. Stripe rust was the dominant disease problem once again. A new biotype of Russian wheat aphid was identified. A hard white wheat incentive program, funded by U.S. Congress, now is in the third of three years. Clearfield wheat is in year two of commercialization, with the cultivar Above occupying > 100,000 acres and a total forecasted acreage of approximately 300,000 acres for 2004. The annual wheat breeders field day was held at Mead, NE, in 2004. Gene Krenzer retired from Oregon State University. Jim Stack was named wheat extension pathologist in KS. Goertzen Seeds merged with Western Plant Breeders to form Westbred LLC. Cargill is a partner in this joint venture.

Material transfer agreements.

A material transfer agreement (MTA) for submitting and receiving lines for the USDA–ARS Coordinated Wheat Regional Nurseries was presented by R. Graybosch. The MTA was developed by the USDA–ARS Office of Technology Transfer. Allan Fritz proposed that item #4 of the MTA be modified to include ‘shall not increase seed without permission of the owner’. Carl Griffey seconded the motion, and the motion was approved. Jim Peterson moved that the NWIC endorse the MTA developed by USDA–ARS for exchange of small grains germ plasm and encourages its use by land grant institutions in the U.S. Ed Souza seconded, and the motion passed.

North American Wheat Workers Conference.

Plans were revealed for the 2nd North American Wheat Workers Conference to be held in Canada in 2007. The NWIC encourages Canadian wheat scientists to move forward with plans for the meeting and pledges our assistance in planning activities.

Bringing genomics to the wheat fields.

Luther Talbert described the history and status of the project. The current goal is to obtain a USDA–CSREES special grant to continue funding with a targeted date of FY2005. The current intent is to obtain funding for the practical application of markers as a component of plant breeding programs and to move away from marker discovery. Questions arose as to how this program will cooperate or complement with ARS genotyping centers and whether the project should be expanded to include additional states. Ed Souza moved that the NWIC endorse the development of a CSREES special grant for marker-assisted selection in wheat breeding programs and will appoint a steering committee to assist in the redraft of the proposal with the goal of making it more competitive and inclusive. Jose Costa seconded and the motion carried. The steering committee will be Ed Souza, Allan Fritz, Jim Peterson, Jose Costa, and Luther Talbert.

Stripe Rust Initiative.

Kim Kidwell, proxy for Kim Campbell, explained that stripe rust was now the major disease in the PNW and has been impacting wheat production in several regions. The Stripe Rust Initiative will include the following focus areas: plant breeding, new gene identification, gene characterization, epidemiology, biotechnology, marker-assisted selection, and disease management. Investigators are recommending funding of approximately \$1.5 x 10⁶, with one-half to ARS and one-half distributed via a competitive grants programs to state programs. The model would be the Scab Initiative. Pullman would be focal point of ARS efforts, especially since Pullman has long been the center of ARS stripe rust-screening activities. Gene Milus suggested a steering committee be named to help establish priorities. A steering committee was appointed and will included Kim Campbell, Chen, Carl Griffey, Marty Carson, Gene Milus, and Lee Jackson.

Karnal bunt Initiative.

Bob Bowden represented the steering committee of the Karnal bunt Initiative. Little progress was noted regarding deregulation. APHIS has a target date of 2007 for worldwide deregulation. The steering committee envisions continued work on epidemiology, spore survival in soil, screening germ plasm for resistance, alternative crops for areas where Karnal bunt has become established, quality assurance such as IP systems for delivering grain from resistant lines, and dealing with tolerance levels.

ARS genotyping centers.

Bob Bowden thanks all involved parties for their efforts in establishing the genotyping centers. At the Scab Forum, a discussion was held to entertain proposals for the operation of the genotyping centers. The goal would be to retain regional foci, have targeted markers/traits, and establish liaison committees. Public versus private breeding was discussed, with the conclusion being that the labs will be open to private firms as long as they adhere to the same rules as public parties. The genotyping center staff will schedule visits to genotyping labs, and basic research would be coordinated among the labs so as to avoid duplication. The establishment of a doubled-haploid lab somewhere to assist in the effort was suggested. An update on genotyping efforts in Canada was provided.

IGROW project update.

The International Genome Research On Wheat (IGROW) effort was discussed and the joint NSF-ARS meeting was described. A position paper describing the effort will be published in *Genetics*, which will include an outline for a 12-nation program to sequence the genome in three phases. The wheat genome is very large and estimates exist of a price tag in excess of \$500,000,000 dollars, but debate exists as to what the real cost will be. Questions still exist as to whether the entire genome or merely the gene-rich regions should be sequenced. An IGROW update is on pp. 13-15.

Wheat gene chip.

Joe Anderson stated that Affymetix is developing a wheat gene chip and they will be funding the project in-house. The chip will have about 60,000 probes. They presently are doing a preliminary test assembly. By mid-2004, the assembly and construction should be completed and for sale.

Graingenes

Olin Anderson explained that Graingenes actually is a set of services, including a database system, a database for Triticeae repeats, and a general communication system for meeting announcements, among other things. Probe distribution efforts are being terminated due to funding constraints. ESTs for the NSF mapping project can be obtained as a set of plates with 8-10,000 genes. Joe Anderson presented results of the liaison committee conclusions and recommenda-

tions to ARS. Some fairly critical funding needs are necessary for the continued maintenance of Graingenes. Problems with the query interface on the web page were discussed and whether the system could be updated without additional funds and staffing. Migrating to a more user-friendly interface will probably take about 2 years. If Graingenes is to continue and improve, additional funding is necessary.

Buildings and facilities.

The Pullman, WA, ARS facility is progressing. The facility will be paired with a state facility and will include all ARS research projects at Pullman, including the new genotyping center. At Fargo, ND, a 57,000 ft² renovation of the bio-sciences research lab is needed, along with a 30,000 ft² research lab (new building) for 8–9 scientists, and a new greenhouse. The ARS facility at Raleigh, NC, has need of a seed-storage facility.

A possible preharvest sprouting position at Fargo was discussed. Interest in such a position exists both for barley and for wheat.

Status of the ARS Cereal Disease Lab, St. Paul, MN.

Marty Carson stated that the building addition will be completed by spring or summer 2005. Yue Jin joined the lab in May 2003. A new proposal for enhanced funding was presented. At present, testing has been reduced to regional samples, with field testing only for the RGON. In the short term, a technician will be hired on a temporary basis to work under Yue Jin in testing germ plasm. In the long term, they would like to have a category-III support scientist to conduct the germ plasm efforts and work more closely with plant-breeding programs. The Cereal Disease Lab should be able to both monitor pathogen loads in nature and determine genes that are present and that are being deployed in new cultivars. Necessary funding for these plans is \$150,000.

ARS regional wheat quality labs.

Charles Gaines provided an update on use of new monies at the regional quality labs. If additional funding is provided, Manhattan will update bake labs and perhaps add new bake team to double the number of samples. Likewise, Pullman has increased samples, but still needs to purchase a new mill and nitrogen analyzer. Fargo added postdoctoral research positions, purchased a seed-cleaning system for more rapid analysis of Wheat Quality Council Systems, but still needs to modernize the spring wheat pilot mill. Wooster increased the number of test line evaluations, added a permanent, full-time support technician, updated equipment including mills, replaced 1930–40s bake equipment, incorporated solvent-retention systems, but still needs to add postdoctorals and remodel laboratories. Labs from the 1960s are worn out with a 5-year remodeling program needed for seven labs. Wooster also will institute a bench-top, cracker-testing system. Fargo was left out of the funding increases for FY04. Funding for these labs has been the top priority for the past few years, but is not quite at the target levels yet.

Cold hardness.

A proposal from ARS Pullman was presented, bundled with the genotyping center at Pullman. Dave Van Sanford suggested deferral of the proposal until a later time, and it was recommended they coordinate with Dave Marshall and his group at Raleigh.

Funding priorities.

After voting by NWIC members, the following priority items, in order of decreasing importance, were recommended

1. regional quality labs,
2. regional genotyping centers,
3. Stripe Rust Initiative,
4. the Cereal Disease Lab, St. Paul, MN,

5. enhanced funding for Graingenes,
6. a sprout position at Fargo, ND, and
7. the Karnal bunt Initiative.

Crop Science policy on exclusion of materials from registration if such materials carry patented or protected traits.

Scott Haley discussed the current policy of *Crop Science* editorial board. A new proposal would allow registration of lines with restricted distribution if the registration would carry the provision that the material could be obtained from the developer via an MTA, or that 5 years after the expiration of Plant Variety Protection, the material would be available via the USDA–ARS Small Grains Collection. Ed Souza proposed that the NWIC recommends *Crop Science* review the policy or registration of materials with patented or protected genes and consider publishing registration notes of PVP varieties that can be distributed under material transfer agreements. Jim Peterson seconded, and the motion passed.

Announcements.

The legislative visit will occur 15–16 March, 2004.

The next NWIC meeting will be held in San Diego, in conjunction with the Plant and Animal Genome meeting, most likely on or about 7 January, 2005. The weather promises to be a tad more hospitable than December in St. Paul, MN.

R. Graybosch, Secretary, NWIC.

*Members of the National Wheat Improvement Committee
July 2004.*

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WHEAT WORKER'S CODE OF ETHICS

This seed is being distributed in accordance with the 'Wheat Workers' Code of Ethics for Distribution of Germ Plasm', developed and adopted by the National Wheat Improvement Committee on 5 November, 1994. Acceptance of this seed constitutes agreement.

1. The originating breeder, institution, or company has certain rights to the material. These rights are not waived with the distribution of seeds or plant material but remain with the originator.
2. The recipient of unreleased seeds or plant material shall make no secondary distributions of the germ plasm without the permission of the owner/breeder.
3. The owner/breeder in distributing seeds or other propagating material grants permission for its use in tests under the recipient's control or as a parent for making crosses from which selections will be made. Uses for which written approval of the owner/breeder is required include:
 - (a) Testing in regional or international nurseries;
 - (b) Increase and release as a cultivar;
 - (c) Reselection from within the stock;
 - (d) Use as a parent of a commercial F1 hybrid, synthetic, or multiline cultivar;
 - (e) Use as a recurrent parent in backcrossing;
 - (f) Mutation breeding;
 - (g) Selection of somaclonal variants; or
 - (h) Use as a recipient parent for asexual gene transfer, including gene transfer using molecular genetic techniques.
4. Plant materials of this nature entered in crop cultivar trials shall not be used for seed increase. Reasonable precautions to ensure retention or recovery of plant materials at harvest shall be taken.

II. ANNOUNCEMENTS & PUBLICATIONS

Announcement of the Third International Wheat Quality Conference (IWQC-III).

The Grain Industry Alliance (GIA) president, Dr. Ron Madl, is happy to announce IWQC-III will be held during May 22–26, 2005 at the Holiday Inn-Holidome, Manhattan, KS. The conference will be co-organized with the American Association of Cereal Chemists (AACC) and the International Association for Cereal Science and Technology (ICC). The conference co-chairs, Dr. Okkyung (Okky) Kim Chung and Dr. George L. Lookhart, view this conference as an update to international quality issues. The conference website will be available shortly.

New publication: Cereal Genomics.

Edited by **P.K. Gupta**, Ch. Charan Singh University, Meerut, India, and **R.K. Varshney**, Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, Germany.

This book is the first of its kind, where 20 chapters written by experts of international repute, cover all aspects of cereal genomics research. In recent years genomics has become a thrust area of research in life sciences, and cereals, being the most important group of crops, their genomes have been subjected to intensive/extensive analyses. The knowledge and the products generated through cereal genomics research already are being used for plant breeding through both, the marker-assisted selection and transgenic cereals. The areas covered in this book include development and use of all kinds of molecular markers (including SNPs); construction and use of molecular maps; study of population genetics; and domestication of cereals using tools of genomics research, structural and functional genomics (including whole-genome sequencing in Arabidopsis and rice), comparative genomics, QTL (including epistatic and e-QTL), and genes for resistance against biotic and abiotic stresses, marker-assisted selection, map-based cloning of genes/QTL, and the use of genomics research for crop improvement. The book, therefore, should prove useful not only for students and teachers, but also for the young research workers, who are starting their research career in the field of cereal genomics. **Cereal Genomics** from Kluwer Academic Publishers, The Netherlands. Details of the book can be found at <http://www.wkap.nl/prod/b/1-4020-2358-8>. Hard cover, ISBN 1-4020-2358-8; eBook, ISBN 1-4020-2359-6.

Contents and Contributors.

1. Cereal genomics: An overview; *P.K. Gupta and R.K. Varshney.*
2. Molecular marker systems and their evaluation for cereal genetics; *D.J. Somers.*
3. Molecular maps in cereals: methodology and progress; *R.K. Varshney, V. Korzun, and A. Börner.*
4. Organization of microsatellites and retrotransposons in cereal genomes; *A.H. Schulman, P.K. Gupta, and R.K. Varshney.*
5. Comparative genomics in cereals; *A.H. Paterson.*
6. Population genetic structure of wild barley and wheat in the Near East Fertile Crescent: regional and local adaptive patterns; *E. Nevo.*
7. Gene and genome changes during domestication of cereals; *C. Pozzi, L. Rossini, A. Vecchiatti, and F. Salamini.*
8. QTLs and genes for disease resistance in barley and wheat; *A. Jahoor, L. Eriksen, and G. Backes.*
9. QTLs and genes for tolerance to abiotic stress in cereals; *R. Tuberosa and S. Salvi.*
10. Marker-assisted selection in the cereals: The dream and the reality; *R.M.D. Koebner.*
11. Map-based gene isolation in cereal genomes; *N. Stein and A. Graner.*
12. Gene distribution in cereal genomes; *K.S. Gill.*
13. Whole genome sequencing: methodology and progress in cereals; *Y. Yu and R.A. Wing.*
14. Bioinformatics and Triticeae genomics: resources and future developments; *D.E. Matthews, V. Carollo, G. Lazo, and O.D. Anderson.*
15. Functional genomics studies of seed development in cereals; *A.S. Milligan, S. Lopato, and P. Langridge.*
16. Functional genomics for tolerance to abiotic stress in cereals; *N. Sreenivasulu, R.K. Varshney, P.B. Kavikishore, and W. Weschke.*
17. The Arabidopsis genome and its use in cereal genomics; *K.P. Mayer, S. Rudd, and H. Schoof.*
18. Rice genome as a model system for cereals; *T. Sasaki and B.A. Antonio.*
19. Cereal genomics research in post-genomic era; *M.E. Sorrells.*
20. Genomics for cereal improvement; *W. Li and B.S. Gill.*

Update on IGROW (International Genome Research On Wheat).

Bikram S. Gill, the Wheat Genetics Resource Center, Plant Pathology Department, Kansas State University, Manhattan, KS 66506-5502, USA.

I introduced IGROW in the 2002 *Annual Wheat Newsletter* (48:14-15). I shall begin by reiterating the vision of IGROW, which is to

- create a knowledge base on the genetics and biology of wheat plant,
- sustain wheat genetic infrastructure and resources, and
- serve as a platform for all wheat stakeholders.

Our immediate, urgent goal is to generate a global physical map and a draft sequence of the gene-rich regions of the wheat genome. Many people on behalf of IGROW have been very active in support of this mandate. I would like to update the activities of IGROW since mid-summer of 2003.

One of the important milestones was a workshop on 9–11 November, 2003, in Washington D.C. on wheat genome sequencing sponsored by the USDA and NSF. This workshop was preceded by a wheat genomics session in Italy during the 10th International Wheat Genetics Symposium, 1–5 September, 2003. At the 10th International Wheat Genetics Symposium, participating scientists from almost 50 countries were enthusiastic about the IGROW mission. The workshop in Washington D.C. was attended by over 60 participants from 12 countries. The workshop produced a blueprint of an international plan for the physical mapping and sequencing the gene-rich regions of the wheat genome, and the report has been accepted for publication in *Genetics* (Gill et al., In press). The nine-point plan of action is as follows:

1. Construct an accurate, sequence-ready, global physical (BAC-contig) map anchored to the high-resolution genetic and deletion maps of the 21 chromosomes (see item 4 below) of hexaploid wheat genotype Chinese Spring.
2. Explore the use of flow-sorted chromosome- and arm-specific libraries towards the assembly of the global physical map and in preparation for the sequencing of the gene containing regions of homoeologous chromosome groups.
3. Identify genomic sequence tags (GSTs) using gene-enrichment procedures such as hi- C_0t or methyl filtration, expressed sequence tags (ESTs), and full-length cDNAs of 2x, 4x, and 6x wheat for an accurate estimation of the wheat unigene set.
4. Leverage rice sequence and wheat–rice gene synteny, comparative genetics, and wheat unigenes towards the development of high-resolution genetic and deletion maps of the 21 chromosomes of Chinese Spring wheat.
5. Identify a random set of 100 gene-containing BACs from the physical map, and another 100 random BACs for sample sequencing, which will provide a test of the gene-rich model and allow refining the technology for assembling sequences with a high repetitive sequence content. Sample sequencing of BACs from different ploidy wheats and genotypes should also be undertaken.
6. Integrate bioinformatics at every step for project management, data analysis, improved methods of sequence annotation, and dissemination of data.
7. Engage all wheat stakeholders, and educational institutions (K–12), globally, especially in developing countries, and locally in all aspects of the research, technology transfer, manpower training, and promotion of science.
8. Maintain all data, materials, and resources in the public domain and free of IPR.
9. Organize an international steering committee to coördinate and execute all aspects of the wheat genome-sequencing project.

The IGROW workshop report was discussed in follow-up meetings of the U.S. wheat workers in Kansas City (February 2004) and at the ITMI workshop in Minneapolis (May 2004). Now, the urgent need is to mobilize the U.S. and the international wheat genetics community for the funding of one or more internationally coordinated pilot projects on wheat genome sequencing. A pilot wheat chromosome group-3 consortium project has been prepared and work has already begun in France (C. Feuillet, personal communication) on the construction of a chromosome-3B physical map using a flow-sorted BAC library (Safar et al., In press). Selective sequencing of specific chromosome regions of Chinese Spring wheat and/or 2x, 4x, and 6x wheat genotypes has been initiated (Boulous and Appels, personal communications). I traveled to India (December 2003–January 2004) and had meetings with Dr. Mangla Rai, DG–ICAR, New Delhi and Drs. Nagarajan and Singh of Indian Agricultural Research Institute (IARI)–New Delhi, and a project has been prepared

for India's participation in the IGROW project. I also traveled to Japan at the invitation of Japan International Research Centre for Agricultural Sciences (Dr. Ban) and discussed the IGROW project with the Japan Wheat Sequencing group (Y. Ogihara, coordinator) and to Canada at the invitation of Mark Jordan to attend Agriculture and Agri-Food Canada genomics meetings in Ottawa (June 2004) to update them on IGROW activities.

Of course, it is always a pleasure to updates on the awarding of new and ongoing wheat genomics projects to the wheat genetics community. Unfortunately, no new wheat genomics grant was funded in the recent round of NSF-Crop Genome Research Program Awards. The news was better from the USDA–NRI, where sizeable grants were funded on genomic analysis of major QTL in wheat for scab (PI: Jim Anderson, University of Minnesota, St. Paul), yield (PI: Kulvinder Gill, Washington State University, Pullman), and frost (PI: Kim Campbell USDA–ARS Washington State University, Pullman). The results of the recently concluded, 4-year project funded by the NSF involving 10 universities on the 'Structure and function of the expressed portion of the wheat genomes' (lead PI: Cal Qualset, University of California, Davis) (project website: http://wheat.pw.usda.gov/cgi-bin/websql/map_locus.cgi) will be published in a series of papers in special volume of Genetics (September 2004). As a result of this project and ongoing work elsewhere, wheat now ranks number one in plants with over 500,000 ESTs (project website: <http://www.ncbi.nlm.nih.gov/dbEST>) and also is the most densely mapped genome with over 20,000 EST loci mapped on the 21 chromosomes of wheat (see project website). Updating the NSF-funded project entitled 'Insular organization of the D genome of wheat' (lead PI: Jan Dvorak, University of California, Davis), a BAC-contig map of the D genome of wheat consisting of 13,647 BAC contigs and 4,000 singletons has been constructed (project website: <http://wheat.pw.usda.gov/PhysicalMapping>). Dvorak is a PI on another NSF-funded virtual center project at UC–Davis on wheat SNPs, a new generation of markers (website: <http://wheat.pw.usda.gov/SNP/index.html>). Shahryar Kianian (North Dakota State University, Fargo) is the lead PI on an NSF-funded proposal and has established a virtual center in wheat mutagenesis and functional genomics at NDSU (project website: <http://wire.ndsu.nodak.edu/DEALING/seedtrack.php>). Jorge Dubcovsky (University of California, Davis) is a lead PI on a USDA–IFAFS project entitled 'Bringing Genomics to the Wheat Fields,' which involves most of the public-breeding programs in the U.S. (project website: <http://maswheat.ucdavis.edu/Production.htm>). Congratulations to these PIs for winning awards from the highly competitive NSF Crop Genome Research and USDA–NRI plant genome programs. The abovementioned proposals are not only producing resources for the wheat genetics and breeding community, but have done much to bolster the position of wheat as a genetic mode for polyploidy research.

On a final note, in addition to the cloning of the *Lr21* and *Vern1* genes reported last year, papers were published in the autumn of 2003 on the cloning of *Lr10* and *Pm3* genes from the laboratory of Beat Keller (Feuillet et al. 2003; Yahiaoui et al. 2004). Congratulations to the Dubcovsky laboratory for their paper on the cloning of *VRN2* gene that was published in *Science* (Yan et al. 2004) and commentary on the paper by Jean Marx (2003).

Publications.

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Call for nominations for IGROW working groups.

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IGROW (International Genome Research on Wheat) was organized in 2002 to complement the activities of the International Wheat Genetics Organizing Committee (IWGOC) and the International Triticeae Mapping Initiative (ITMI). The IGROW mandate is to coordinate and provide direction to wheat research. The wheat genetics community will identify the best scientists who will coordinate and provide leadership to different areas of wheat research. We are now seeking nominations for working groups who will coordinate research and develop community resources in the following ten areas:

- ✓ Bioresources: working groups on wild species, mutants and mapping populations, cytogenetic stocks, and DNA libraries.
- ✓ Genomics: working groups on structural and functional genomics.
- ✓ Proteomics (lipidomics and metabolomics).
- ✓ Transformation and genetic engineering.
- ✓ Chromosome engineering and alien transfers (this could be same as cytogenetic stocks working group).
- ✓ Genetics of wheat–pest interactions.
- ✓ Wheat plant physiology.
- ✓ Breeding and crop improvement.
- ✓ Wheat utilization.
- ✓ Bioinformatics.

I should emphasize that we must organize ourselves as a more cohesive and proactive group if wheat is to stay competitive as a genetic model and as a profitable crop for wholesome nutrition. Herein, we have an opportunity to involve diverse types of wheat expertise on a focused program. I shall appreciate your feedback and nominations of scientists from public and private organizations at the international level for the various working groups. The aim is to get the working groups organized as soon as possible and begin their deliberations so that they can prepare and present their reports to the whole group next year.